Interdisciplinary Experiential Education of Intellectual Property Concepts in an Engineering Context

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Abstract—**Drawing from a curricular model proposed in a recent report from educators in the UK, this article examines the need to educate US engineering students in intellectual property concepts through partnerships between law students and undergraduate engineering students [1]. The educational vehicle that is the focus of this article is the engineering senior capstone design project. In the proposed pedagogical model, law students studying intellectual property will take on the role of advisors to engineering students (their clients) while the latter group endeavors to develop an engineering solution to a real world problem. This article also seeks to identify and address concerns of licensing authorities and professional associations that may arise as a result of implementation of the model.**

Keywords-component; engineering students; intellectual property; capstone design project; pedagogical model

I. Introduction

Engineers as designers of commercial products and systems are at the center of the innovation cycle. As noted in a publication from IEEE's Intellectual Property Committee [2]:

> Engineering embraces those technical arts that yield practical benefits for the human race, such as safe bridges, new chemical processes, better television and radio systems, and faster and quieter aircraft. Engineers are professional innovators—prolific intellectual property creators by the very nature of their profession.

Unfortunately, engineers are often unaware that they are making decisions during the design process that can have an impact on various types of intellectual property protection. One approach to address this gap would be to instill an awareness of intellectual property concepts in undergraduate engineering programs through collaboration with law students who have specialized training in intellectual property. This would enlighten engineers so that decisions they make later in their careers become more deliberate and thoughtful and, at the same time, would allow law students to sharpen their knowledge of the substantive area of law as well as to hone client interviewing and counseling skills.

Current literature suggests that both populations reap significant benefits from experiential learning opportunities. [3] [4] [5] [6] [7] [8] [9] Realizing those benefits may be hindered, however, if licensing authorities or professional associations object to either type of student involvement in project work on the grounds that it constitutes practice of the profession by individuals who lack the requisite experience and credentials. This article will outline a pedagogical model involving law students studying intellectual property and undergraduate engineering students, which could be used in a senior engineering capstone design course, paying particular attention to concerns that implementation of the model may raise vis-à-vis both professions.

II. Understanding the Problem

Students graduating from an undergraduate program in engineering are faced with challenges unknown to their peers of 20 or 30 years ago. Two of these challenges are:

- Soft Skills - Increased pressure by the engineering profession (and thus the accreditation and regulatory bodies) for graduates to develop competencies in areas such as communication, teamwork, societal impacts of their work, business concepts and contemporary issues, or the "soft skills". [10].
- Capstone Design Experience - The pedagogical requirements associated with senior capstone design experiences are multi-disciplinary, both within the particular engineering discipline and outside of the discipline, in order to address real-world engineering problems and handle the varied professional issues that arise. [11].

A. *The "Soft Skills" Engineering Graduates Need*

For several centuries the definition of what it meant to be an engineer varied significantly from country to country based upon the unique historical development of engineering within any given country. In the last several decades, engineering as a profession has evolved due to advances in materials, new manufacturing technologies, increased computational power, novel and enhanced communication methods, challenging economics and the forces of globalization. This has and will continue to present new challenges to the engineering educational system in terms of the competencies engineering graduates must possess in order to address the technical environment and the global nature of their professions. Today, engineers must expect that they will be working abroad or with engineers from other countries. Multinational firms are expressing a preference to hire people with mobile engineering talents [12].

In the US, ABET, Inc. (formerly known as Accreditation Board for Engineering and Technology) has recognized this paradigm shift and has modified its accreditation criteria so that it is now focuses on the learning outcomes of engineering graduates rather than on the structure of the educational curriculum and programs. [13]. At one time, accreditation of engineering programs by ABET was once based upon required foundation courses--mathematics, chemistry and physics--and technical courses--analytical and design--within a particular engineering curriculum. ABET's approach was typical for engineering accreditation in many parts of the world. Roughly a decade ago, ABET revised its accreditation process and required engineering programs to demonstrate that their graduates have attained a desired set of outcomes. The following lists 6 of the 11 required outcomes:

(c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability

(d) an ability to function on multidisciplinary teams

(f) an understanding of professional and ethical responsibility

(g) an ability to communicate effectively

(h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context

(j) a knowledge of contemporary issues.

The list places significant emphasis on skills that go beyond the traditional technical oriented topics found in mathematics, science, and engineering analysis and design courses. These skills focus on an engineer's ability to demonstrate technical competence and have a broader understanding of contemporary issues like ethics, business concepts, economics, intellectual property rights, and societal impact. The set of competencies that is being promoted by engineering accreditation and regulatory bodies around the world today includes soft skill competencies such as teamwork, communication, risk management, safety, ethics, project management, business practices and life-long learning. [14][1] The concepts associated with intellectual property protection are embedded in many of the competencies mentioned above.

One engineering professional organization, the American Society of Civil Engineers (ASCE), has been working on articulating the characteristics needed for a Civil Engineer in the year 2025 in order to meet the needs of a global society [15] [16]. The report, Achieving the Vision for Civil Engineering in 2025: A Roadmap for the Profession, sets an aspirational target in which civil engineers will be entrusted with helping to achieve a sustainable world and raise the overall quality of life. In order to accomplish this, engineers need to become master innovators and integrators of technology and the soft skill competencies mentioned earlier, including a basic knowledge of intellectual property concepts, will be vital to their success.

Robert J. Kuntz stated [17],

> America's intellectual capital is seriously at risk and the role of engineering education in saving it is pivotal. But first and foremost, academic leaders must understand that this potential loss — of no less than the cumulative body of technical knowledge and engineering skill that in the past made the United States a leader in the global economy — could be catastrophic. And then, they must take action.

Kuntz goes on to say that there are two disturbing trends; the financial industry's treatment of intellectual capital as a commodity to be quantified for maximum shareholder value and return on investment, and the practice of withholding intellectual property rights from the scientists and engineers, inventors and innovators. It is his opinion that the engineering schools can play an essential role in effecting this change by developing curricula which includes the topics of intellectual property, entrepreneurship, and patent law.

Additionally, Robert McLaughlan holds the view that engineering graduates need to have some fundamental understanding of intellectual property rights since this understanding is key to the working life of engineers and related creative professions [18].

B. The Capstone Design Experience

In order for engineering students to be prepared to enter the world of engineering practice they must complete a curriculum culminating major design experience. This is often referred to the senior capstone design project and it is based on the knowledge and skills acquired in earlier course work and incorporate appropriate engineering standards and multiple realistic constraints [19]. The capstone design experience is often is a two-semester course sequence that emphasizes data gathering, engineering analysis and design, invention, innovation and entrepreneurship. Capstone projects are offered in a wide range of pedagogical approaches from fictitious engineering scenarios to feasibility studies of real-world problems. The course typically incorporates a client-driven project that has significant professional challenges [20].

One example of the latter is WERC's Environmental Design Contest (www.werc.net) where teams of students design approaches to address real-world problems. During the design process the teams develop fully operational bench-scale solutions that are presented to panels of judges comprised of environmental professionals. Each team prepares four different presentations: written, oral, poster and bench-scale model. It is an event that brings together industry, government and

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[1] Washington Accord 2007 is an international accreditation agreement for professional engineering academic degrees, between the bodies responsible for accreditation in its signatory countries—signatories are US, UK, Australia, New Zealand, Canada, Japan, Korea, Ireland, etc.

academia in the search for improved environmental solutions. Part of the judging is based upon originality which would lead one to believe that intellectual property concepts might come into play. If this issue was mentioned on the web site for the contest, the authors were not able to find it.

Engineers without Borders – USA (www.ewb-usa.org) is another example where student volunteers develop solutions to real-world problems. The following is a portion of their stated mission:

> EWB-USA helps create a more stable and prosperous world by addressing people's basic human needs by providing necessities such as clean water, power, sanitation and education. EWB-USA's strength comes from its over 300 dedicated chapters, including university chapters on 180 campuses in the United States. Because of its strong university presence, EWB-USA is the catalyst for a new movement to educate the next generation of socially conscious engineers deeply aware of the needs of the rest of the world.

The idea of EWB-USA is to engage university students (many of which are undergraduate engineering students) in developing solutions to real-world problems in impoverished areas of the world. The University of New Hampshire chapter has designed solutions for small villages in Thailand (water and wastewater treatment facilities) and in Niger (irrigation system in a desert region). In each case the students developed a solution to address the problem and then a team of students would travel to the site to be part of the construction team with local people.

While projects associated with each of these organizations (WERC and EWB) are quite intense and demanding, both in terms of time and energy, they are very popular with the students because they address real problems and the students have an opportunity to directly benefit a group of people. Due to the nature of the problems it is realistic to think that many of the design solutions, including engineering methods and products, developed by the students would have the potential to be patented. It is also fair to say that most of the students involved with these projects have little to no knowledge of intellectual property concepts and what impact these topics would have on their design solutions.

III. Design Phase Decisions That Impact Intellectual Property Protection

A key obstacle to integrating the study of intellectual property into the engineering curriculum is a prevailing notion among academics that the subject matter is marginal to the overall education of engineers [21]. The discussion above illustrates the fallacy of that notion: engineers as professional innovators must develop an appreciation for intellectual property protection and incorporate that understanding into the design decisions that they make. The optimal time to instill that appreciation is at the undergraduate level when engineering students are learning the design process so that intellectual property concepts integrate seamlessly into engineering solutions at key points in their education. The discussion below provides an overview of intellectual property concepts and briefly illustrates the variety of decisions that engineers make during the design process that have an impact on such protection.

A. *Intellectual Property Generally* [22]

"Intellectual property" denotes intangible property, a reference to the fact that it cannot be seen or held and generally arises through the creativity of the human mind. Despite its intangible nature, intellectual property can only be protected if it has been described in writing and drawings, as in a patent application, is capable of being expressed in writing, as in trade secret formulae, or is expressed in tangible form, as in copyrighted software or a trademarked product.

Rights that accompany the various types of intellectual property are said to be rights of exclusion because they allow the holder of the rights to prevent others from exploiting the intellectual property at stake. Exclusionary rights accompanying patents and copyrights are granted by the federal government and are time-limited; when the term expires, the subject matter of the patent or copyright is open to the public.[2] A patent excludes others from making, using or selling the patented invention, and a copyright excludes others from unauthorized copying, distribution, and adaptation of a work. Trademarks and trade secrets, on the other hand, do not require a grant from the government and are potentially unlimited in duration. A trademark arises from use of a mark in commerce in conjunction with specific goods or services and acts to exclude others from using the same or a similar mark with such goods or services. A trade secret may be any information that derives commercial value as a result of not being generally known and that is subject to reasonable measures to maintain secrecy.

B. *Utility Patents* [23] [24] [25]

Because engineers are often confronted with complex technological problems, their solutions may be sufficiently inventive to qualify for a utility patent. Utility patents may be granted for "any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof" [26].

In order to preserve the viability of patentable subject matter, record-keeping is a critical skill for engineers to master. Most engineers understand the need to document experimental efforts from the standpoint of maintaining a coherent approach to research but engineers also need to know that record-keeping serves a legal purpose by providing an evidentiary paper trail. If a utility patent application is rejected by the U.S. Patent and Trademark Office (USPTO), or it is issued by the USPTO and its validity is later challenged in infringement litigation, records maintained during the research and development phase of an invention will corroborate the inventor's sworn statements submitted in support of the patent grant. Accordingly, it is

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[2] The term of a utility patent is 20 years from the date of the earliest U.S. application filed, 35 U.S.C. §154(a)(2), and the term of a design patent is 14 years from the date of the grant, 35 U.S.C. §173. The term of copyright protection for a work made for hire is 95 years from the date of publication or 120 years from the date of creation, whichever expires first. 17 U.S.C.§ 302(a). In general, a work not made for hire is protected by copyright for the life of the author plus 70 years. 17 U.S.C. §302(c).

imperative that engineering students understand and implement proper record-keeping procedures.

Such records can be particularly important for purposes of establishing the timeline of invention. For example, in the US, an inventor may provide evidence to "swear behind" prior art cited by the patent examiner to reject pending patent claims. Prior art simply refers to anything in a particular field of technology that arose in time before the inventor's invention. If the prior art was published within one year before the filing date of the application but after the invention was actually reduced to practice, i.e., after the invention was shown to work, the patent applicant may overcome the patent examiner's rejection. A documented timeline can also resolve conflicting claims of inventorship and resolve the question of who was first to invent.

An engineer needs to be particularly attuned to his own actions that may create a bar to issuance of the patent, or if issued, may invalidate it in later litigation. The critical date for such actions is one year before the filing date of the patent application. Prior to the critical date, a printed publication disclosing the invention, in the U.S. or abroad, a public use of the invention in the U.S., or putting the invention on sale in the U.S., are all actions which will create invalidating prior art. Offering the invention for sale is self-explanatory and is easily avoided by an engineer but other bars may not be so obvious. Printed publications available to the public may include graduate or undergraduate theses cataloged and available in a university library or they may include other publically available material that does not consist of word, such as a diagram or a flow chart. Use for experimental purposes is not invalidating public use but the engineer needs to know that use to determine market response will not qualify as experimental use and, further, that use in the presence of anyone not subject to a confidential nondisclosure agreement risks being an invalidating public use.

In the US, the actual individual inventor(s) must be named in the patent application. A true inventor conceives the solution to a problem and that solution must be captured in the claims of the patent. Joint inventorship occurs when two or more people, working together, each make a meaningful contribution to conception of the solution and, once again, the solution is the claimed invention. Although it is assumed that an inventor is the owner of his patentable invention there are several situations in which that is not the case: when a contract to assign the invention exists between an employer and the employee/inventor; when an employee is retained specifically to solve a problem that results in a patentable invention; and when the employee uses his employer's resources to conceive or build the invention giving rise to a shop right or nonexclusive, royalty-free license to the employer to use the invention. For student engineers, the foregoing is instructive because many universities have policies that bind student inventors in similar fashion, for example: where the student is an employee of the university and the invention arose in the course and scope of employment; where the student is a co-inventor with someone who is an employee of the university; or where the project giving rise to the invention required significant use of university facilities and equipment. See, for example, the IEEE-USA policy statement on this issue [27].

C. *Design Patents* [28] [29]

Because engineers are geared towards technological solutions to engineering problems, they are more likely to consider utility patent protection for a new device or product and neglect thinking about design patent protection. Design patents are the obverse of utility patents and protect only the way a device or product looks and not how it works. In short, a design patent will be issued only to one "who invents a new, original and ornamental design for an article of manufacture" [30] and will not cover any feature of the device if it is primarily functional. Although it must not be useful, a design feature must still meet novelty and nonobviousness requirements in order to be awarded a design patent.

Design patents have become particularly important with the increase in the introduction of counterfeit products to the US market in recent years because design patents provide more robust coverage than trade dress or copyright protection and usually issue from the USPTO far more quickly than utility patents. As a consequence, a design patent can prevent a competitor from copying the aesthetics of a successful, new product thereby delaying, and possibly preventing, the competitor's entry into the market.

It is critical for engineers to understand that design protection can be obtained on very functional items so long as the patent is directed to the ornamental aspects of the item. All of the cautions critical to an engineer with regard to utility patents—good record-keeping, the statutory bars of printed publications, public use, and offers for sale, and naming the true inventor(s)—hold true for design patents as well.

D. *Copyrights* [31] [32]

Although not as vital to engineers as patent law, copyright law can impact engineering design. Copyright law offers protection for the concrete way in which an individual expresses his intellectual creativity. Specifically, federal law provides that copyright protection exists for "original works of authorship fixed in any tangible medium of expression" [33]. Importantly, this provision means that no protection exists for facts because, in and of themselves, they are not original, and no protection exists for ideas unless they have taken tangible form, as in the written word, a musical composition or a recording, a work of art or architectural structure, etc. Because copyright rights arise automatically upon expression of an original idea in tangible form, formalities, such as federal registration or affixation of copyright notice, are not required to trigger protection.

Unlike design patents, copyright protection is not generally available for the aesthetics of mechanical or useful articles except in the following instances. To the degree that a pictorial, graphic, or sculptural feature can be identified as existing independently of the utilitarian object in which it is embodied as, for example, a drawing printed on a coffee mug, it may be protected by copyright. Of more importance to an engineer, however, is the fact that copyright law will prevent others from copying the nonfunctional aspects of an architectural structure (as well as any blueprints or specifications for the structure). This protection is limited to structures that are habitable by human beings, such as houses and office buildings, and to other permanent and stationary structures intended for human occupancy, such as churches, museums, and gazebos, but does not extend to public structures such as bridges or dams.

Copyright law is particularly important to software engineers because it is the predominant type of intellectual property protection available for computer software. It is not uncommon for software to be developed, either in an employment relationship, or as a result of being specially commissioned to create it, i.e., as a work for hire. In the first situation, the employer will be deemed to be the author of the software unless there is a written agreement to the contrary between employer and employee. In the second situation, the independent contractor is deemed to be the author unless there is a written agreement between the independent contractor and the hiring party designating the software as a work for hire *and* the software must relate to one of the nine uses specified in the statute.[3] [34]. Student engineers should be attuned to the work for hire doctrine as their authorship rights may be impacted by any written agreement between themselves and their university as well as by any university policies with regard to their obligation to transfer ownership of copyrights obtained as the result of student work.

E. *Trade Secrets* [35] [36](Rockman 2004, Medlen 2000)

Trade secrets confer a competitive advantage on the holder of the secrets and may include such diverse items as a technique, a chemical formula, computer software, or a customer list. Of course, independent development of the trade secret information by a third party, achieved without engaging in unlawful behavior or breaching a confidence, is acceptable. Engineers who are employed by trade secret owners will likely be required to sign a confidential nondisclosure agreement. Typically, such an agreement describes the type of trade secret information to which the engineer will be exposed in the course of employment and exacts a promise not to utilize the information for the benefit of any entity other than the current employer. It is vital for an engineer to observe the employer's procedures for maintaining the secrecy of such information during research and development activities and, when moving from one employment position to another, the engineer must be alert to the obligation to refrain from misappropriating a previous employer's trade secrets in the course of performing engineering services for a subsequent employer.

F. *Trademarks and Trade Dress* [37] [38]

Although most engineers are not responsible for marketing, they do need to understand the constraints that trademark law places upon them with regard to using others' trademarks and with regard to designing proprietary trade dress for new products. Trademarks and trade dress function to identify a distinct commercial source for a particular type of goods or services; in other words, they signify brands within a particular product or service category. A trademark may take a variety of forms, including a word, a logo, a set of numbers, a sound, a scent, or anything that can be perceived by the senses of the relevant consumers.

In order to develop instruction manuals or other written material that may be distributed to the general public, engineers should follow certain guidelines in using the marks of their employers or those belonging to third parties. Specifically, engineers should take care to use trademarks as adjectives modifying a noun, e.g., Xerox photocopiers or Xerox photocopies, and not as nouns or verbs themselves, which would amount to use of the trademark as a generic term, e.g., Xeroxes or Xeroxing. If the trademark becomes a generic term, it ceases to designate commercial origin and loses all value. Additionally, if the written materials refer to a third party's trademarks, the engineer should attribute proper ownership of such marks and should do so in a way that avoids confusing the public as to the commercial source of the third party's goods or services.

Trade dress is a specific type of trademark and refers to the overall image of a product, including such attributes as configuration and packaging. Because product configuration may act as a trademark—the shape of the Coca-Cola bottle, for example—design engineers need to keep in mind the requirement that protectable trade dress must not be functional. The nonfunctionality requirement does not refer to utilitarian functionality but does refer to the competitive effect of the design feature: for example, if the feature represents the most cost-effective or the most efficient way to structure a product, the feature cannot become proprietary trade dress as that would impede fair competition in the relevant product category. For this reason, trade dress protection is rarely compatible with utility patent protection but co-exists alongside design patent protection with little problem.

IV. Implications of the Pedagogical Model For Licensing Authorities And Professional Associations

Licensing authorities and professional associations may interpret state statutes governing the "practice of" engineering or law or the provision of either type of "professional services" in such a way as to block student involvement in a capstone project geared towards providing an engineering solution to a real world problem. Because licensing statutes are the public's guarantee against incompetence and because professional associations advance this goal through standard-setting, continuing education, and self-regulation of their members, some accommodation must be found in the pedagogical model to address valid concerns while preserving a pathway to effective learning.

A. *Law Students: "the practice of law"*

Law students must be guided by the prohibition against the unauthorized practice of law as set forth in each state's code of professional responsibility (Rule 5.5) [39]. Although the definition of "the practice of law" varies widely from one state to another, a law student providing legal advice outside the supervision of a licensed attorney unquestionably would constitute a violation of state law and likely would prevent the student's subsequent licensure upon graduation. [40] To comply with that restriction, law schools in the US typically

[3] The use most commonly invoked for software is as a "a compilation," defined in the cited section as "a work formed by the collection and assembling of preexisting materials or of data that are selected, coordinated, or arranged in such a way that the resulting work as a whole constitutes an original work of authorship." 17 U.S.C. §101.

offer experiential learning opportunities through law school clinics in which students represent live clients under the supervision of clinical professors who are attorneys licensed to practice law in the relevant state. Moreover, law school clinics generally confine representation to indigent clients as an accommodation to local bar associations [41]. Supplying a clinical professor to supervise law students working only indirectly with a live client may not be an efficient use of resources and also poses a problem vis-à-vis local professionals because the indirect client involved in the senior capstone engineering project generally will not be indigent. In other words, the law student may be viewed not only as unqualified to offer legal services but also as an interloper interfering with business that licensed practitioners would otherwise receive. Additionally, most clinical professors are not registered to practice patent law before the United States Patent and Trademark Office (USPTO) and, so, should not be rendering advice with regard to patent protection[4] [42]. The most viable solution is to utilize adjunct faculty licensed to practice patent law as it complies with the ABA stricture against the unauthorized practice of law and also appeases local bar associations because it is local practitioners from which qualified adjuncts will be selected.

B. Engineering Students: "the practice of engineering"

The senior capstone project presents the soon-to-be graduate with a culminating educational experience. The experience allows students to use the knowledge they have gained throughout their engineering program to address a real-world problem. At this level, students have no desire to invest time and energy doing what they characterize as "make work". The senior capstone experience is a student's last educational opportunity to demonstrate that he or she has acquired the desired technical and professional competencies and it must be interesting enough to capture the student's interest. This need for a real-world engineering problem poses an inherent conflict because it raises the specter of having the students perform work at a level that might be considered equivalent to the "practice of engineering"—a matter that has legal and safety implications.

The primary mission of engineering has always been to improve the lives of people through advancements in medicine, new communication methods and managing aspects of the environment, to name just a few. Although this mission seems implicit, it has not always been publicized and has only recently taken front and center in university curricula in order to attract a greater numbers of students. For a period of time following World War II there was a steady and sufficient stream of students entering college as engineering majors. In recent years, the number of individuals attracted to the profession has been declining. In order to reverse this trend and to recruit a more diverse group of students, the social mission of engineering is being emphasized with the result that a more diverse student population is entering engineering programs and looking for educational experiences that reinforce the notion of engineers as agents of social change. And this is where interpretation of "the practice of engineering" comes to bear on the work the students perform.

A common definition of "the practice of engineering" follows:

> 310-A:2 Definitions. As used in this subdivision: [43]
>
> III. Practice of engineering means any professional service or creative work: requiring education, training, experience, and the application of advanced knowledge of mathematics and physical sciences, involving the constant exercise of discretion and judgment, to such services or work as consultation, investigation, evaluation, planning, design, responsible oversight of construction, and responsible oversight of operation, in connection with any public or private utilities, structure, buildings, machines, equipment, processes, works, or projects, wherein the public welfare, or the safeguarding of life, health or property is concerned.
>
> 310-A:2-a Purpose. To safeguard life, health, and property, and to promote public welfare, the practice of engineering in this state shall be regulated by the board of professional engineers, except as provided in RSA 485-A:4 and RSA 485-A:35.

The statute quoted above and the interpretation of "the practice of engineering" found in the NH Administrative Rules reveal many of the tasks associated with a robust capstone design experience [44].

Are these student projects a violation of the state statute on "the practice of engineering"? These projects are educational exercises using very real and complex problems, generally with actual clients. But, they are still just educational exercises. The intent is to provide students with an educational opportunity to apply their knowledge, creativity and energy to projects that have the ability to improve the lives of others. The student benefits educationally and the client benefits by exposure to engineering solutions that otherwise might not be feasible [45] [46]. It is definitely not the intent of these projects to replace the work of a professional engineer. One of the best outcomes for students involved in a capstone design experience is to have the client, working with a professional engineer, take their final report and elevate it to the next level – implementation.

V. CONCLUSION

Curricular intervention to include intellectual property training for undergraduate engineering students is critical to the holistic education required of today's engineers. The literature supports intervention in the form of experiential learning and does so for students studying both engineering and law. When offered in an interdisciplinary setting, as the pedagogical model described in this article proposes, this type of learning instills an early awareness of the importance of intellectual property and sharpens the future engineer's ability to make thoughtful

[4] Registration to prosecute patent matters before the USPTO generally requires an undergraduate degree in either one of the natural sciences or an engineering discipline in addition to successful completion of the USPTO's registration exam. Both lawyers and nonlawyers may register to practice patent matters in front of the USPTO, the former as a patent lawyer, the latter as a patent agent. 37 C.F.R. §11.6. Holding oneself out as qualified to render advice on patent matters in the absence of registration to practice before the USPTO would violate strictures against false and misleading indications of specialization under relevant state law. (Rule 7.4(b), ABA Model Rules of Professional Conduct 2006).

decisions regarding such matters. Additionally, the model has the salutary effect of allowing future intellectual property lawyers to hone the skills they will need to interact with engineers once they join the bar. Engineers and lawyers trained in this fashion will ultimately advance the credibility of their respective professions. As a consequence, any objections to implementation of the pedagogical model by licensing authorities and professional associations must be overcome to benefit not only the students but also the public as a whole.

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